eo•body

user's manual 1.0

ircam
Centre
Pompidou

eowave

Safety instructions

WARNING

Before using ***eo•body***, make sure you have read the following instructions carefully, as well as the instructions for use.

• Do not open or modify ***eo•body*** or its main adapter.

• Do not try to repair the interface or the components inside of it.
Please contact eowave for technical support.

• Do not use ***eo•body*** nor store it in the following conditions:
- Extreme temperatures, or exposed to direct sunlight.
- Damp areas.
- Dusty areas.
- Areas prone to strong vibrations.

• If you replace the main adapter, make sure its output polarity, voltage and current are correct.

• Do not insert any objects nor pour any liquid into ***eo•body***.

• Protect ***eo•body*** against violent shocks.

• Before using ***eo•body*** in a foreign country, make sure the main adapter provided is compatible with the main supply.

• If ***eo•body*** will not to be used for a long period, disconnect the adapter from the main.

• Never place heavy objects on ***eo•body***.

• Never touch ***eo•body*** nor the adapter with wet hands when it is plugged in.

• Before moving ***eo•body***, make sure the main adapter and/or any external elements are disconnected from the unit.

• Before cleaning ***eo•body***, make sure the main adapter is not plugged.

• During ligthning, unplug ***eo•body***.

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Congratulations!

We thank you for choosing ***eo•body***, the essential link between the world of analogue sensors and the digital world of computer processing. The idea of this joint development between Ircam & eowave was to offer the most easy-to-use analogue to MIDI interface for an affordable price. Of course, other analogue to MIDI converters have already been developped in the past, but none have ever linked simplicity to quality and price like ***eo•body*** does. And indeed, the use of such tools has often been limited or been specially designed for big projects because of the high cost such installations usually require. ***eo•body*** interface is based on the analogue to MIDI converter Atomic Pro which has been developped by Emmanuel Flety Ph.D. & engineer at Ircam. With this high-end embedded technology, ***eo•body*** offers high quality data processing, including subsampling and internal filtering capabilities.

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Unpacking

Your ***eo•body*** package should include the following items. Make sure everything is in the box.

- ***eo•body***
- an AC/DC adapter 9 V/500 mA (European standard plug)
- one pigtail cable D-SUB 15 to 8 Jack plugs 1/4“/ 6,35 mm
- a CD containing:
  - the user's manual
  - a free editor for Mac (OS9 and OSX)
  - examples of objects and patches for use within Max.
- a registration card

Write down the serial number of your *eo•body* for future reference!

#

Who's Who

Ircam

Ircam was founded as a place that combines scientific research, development of related technologies and contemporary musical creation, for the benefit of the musical and scientific communities. One of the main goals is to contribute, through science and technology, to the renewal of musical expression. Reciprocally, specific problems related to contemporary creativity have lead to original steps in the scientific field, with theoretical, methodological and applied aspects. One of the main links between research and the musical production activities is done through the development of software environments for composition, that integrate models and prototypes which come from research teams working in various fields related to music: computer science (languages, human-computer interface, realtime, database management), digital signal processing, acoustics, psycho-acoustics and cognitive psychology of audition. Knowledge and tools are also applied to fields of activity in the industry that go far beyond contemporary musical production.

« At Ircam, my work is mainly oriented towards the design of electronic hardware for stage and live performance applications. The aim of this design is to provide composer sand performers new tools for expression and control in order to communicate with the computers involved in computer assisted compositions and musical piece interpretation (sound processing, sound synthesis, sample triggering, spactialization…).
One of those tools is AtoMIC Pro (Analogue to MIDI Converter). This device digitizes analogue signals from sensors to transmit them to the computer which might use those information as a «vision» of the outer world, so our five senses do. Thus stimulated, the machine can «answer» and take certain decisions depending on what happens on stage. This tool is very useful in the field of interactive sound and/or video installations where it is possibly needed, for instance, to detect a person at the key place in order to trigger a sound sample, or to measure the activity in a room to control the volume of a sound effect. »

Emmanuel Fléty, Ircam.

eowave

« eowave was founded in 2002. Since 1998, we have designed our first products under the name of More Electronic Sounds. We have started with the development of software and stepped on hardware design of analogue machines and midi tools. There is not such a big gap between developing software and hardware: both are a subjective representation of the definition of the sound process. I really enjoyed developing iSynth. With the Essential Instruments from Cycling'74's Pluggo 3, each module is dedicated to a special synthesis: granular, additive synthesis, FM, an analogue modeling synth or a wavetable synth… I have tried to extract the essential of synthesis, starting all over again with fundamental questions: «what's an FM synthesis & how should it be concretized?» Now, some analogue effects I have designed - the little analogue effects called the «bugs» for example - can be viewed as some kinds of hardware Essential Instruments. Several little boxes, each representing an effect, a multimodal filter, a ring modulator, a phaser or a sequencer. Several little boxes any musician can use to add an analogue feeling to his music… Several easy-to-use little boxes which can be used alone or assembled to create new sounds. But aside the search for new tools, and new ways of expression is a real quest among unknown dimensions. The world of synthesis is immense, while the world of expression has no limits. At this frontier comes ***eo•body***, an ideal intermediate between the external audio and video environment and the artist, the essentiel bridge linking the world of analogue sensors to the world of digital process. »

Marc Sirguy, MESI/***eowave*** CEO.

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I - Sensors & new ways of expression

From the Idea...

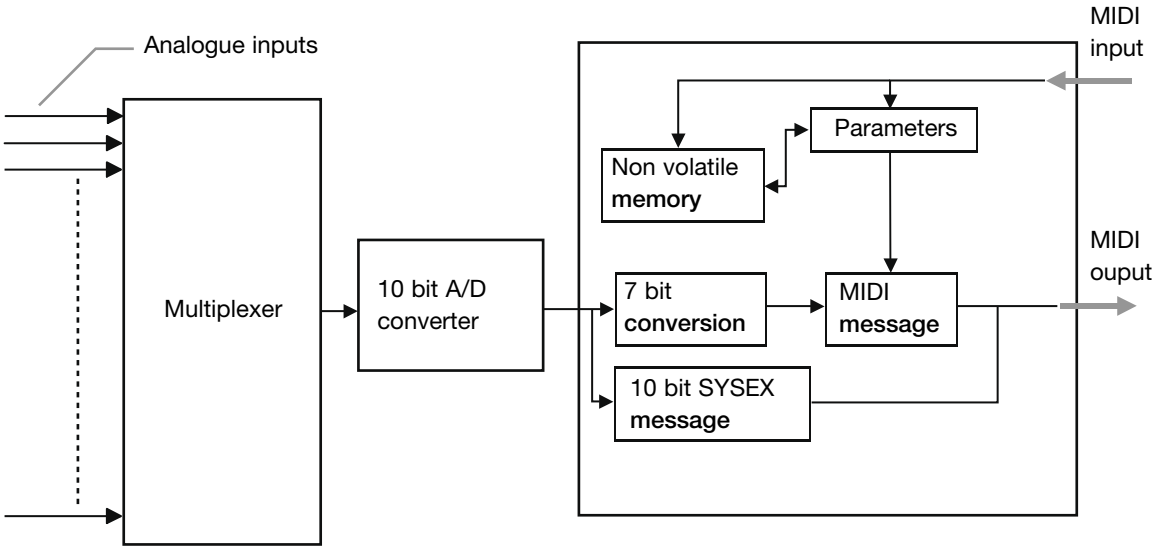
Men have always dreamt of new ways of communication. Through ages, men have thought of their body as a tool of communication. And indeed, when communicating, this is not only your voice, nor the only expression in your face that transmits a message, but your entire way of being. This is your entire body which projects you inside the individual world of one another. In all cultures, men have developped new ways of communication through dance, music, art. And still in a matter of a better communication, men have always worked to improve the interaction between men and machines, thus since the very beginning of mechanics and later, electronics. More and more, the body has become the cornerstone of interactive systems of communication. New technologies widen the range of controls. And controls have entered everyday's life without us noticing. Remote controls are everywhere: we control TV, we control VCRs, DVDs, stereos, ovens, climates, windows, garage doors… Control surfaces are everywhere. Faced to art, control appears to be the new way of expression of this early millenium. Many artists are looking for new ways of expression, of conceptualizing ideas… In this perspective, sensors open new dimensions of expression. ***eo•body*** is the key link between the world of analogue sensors and digital systems.

...To the Realization

The need of new technologies to control the sound has increased with the development of interactive sound installations and interpretation of musical pieces requiring interfaces other than traditional instruments. ***eo•body*** is the intermediate you need to connect sensors of any kind (faders, mechanical pressure sensors, piezo electric sensors, infrared barriers, intruder detector/passive IR sensors, temperature sensors, etc.) to a musical MIDI environment (sequencer, computer, sampler…). ***eo•body*** does not impose the sensor type and features portability and versatility. It can be used for sound synthesis control with the jMax environment (Real time team), PD or Max/MSP. As another example, ***eo•body*** can also be used for the control of a MIDI/digital audio sequencer with an original and completely new user interface.

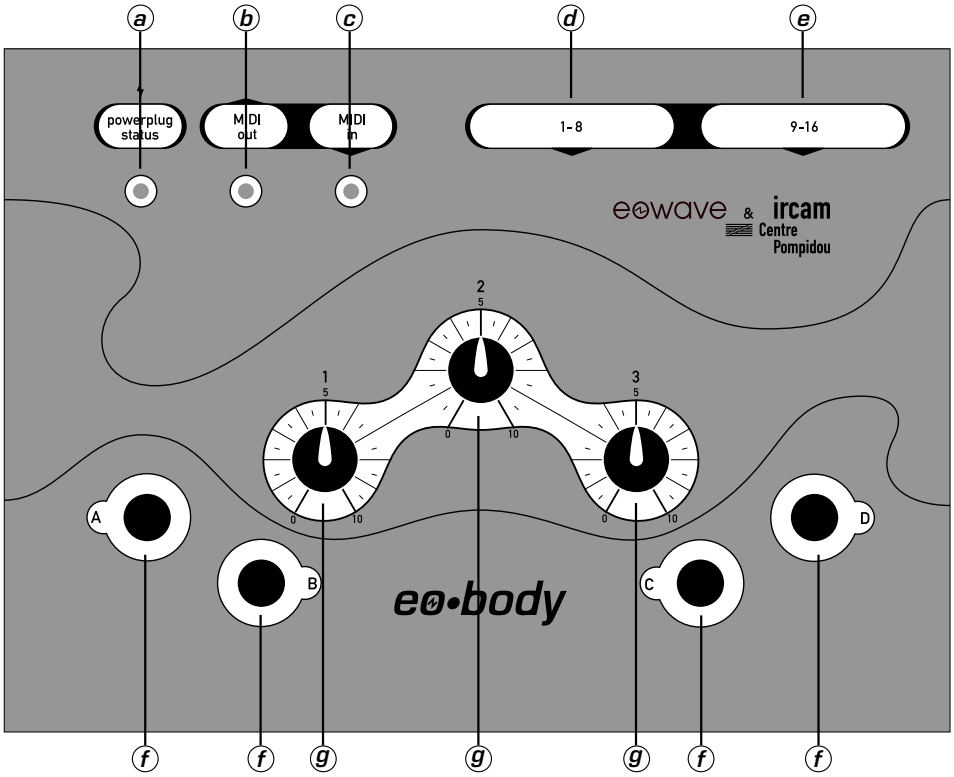
The MIDI digital code allows to transmit many different data sources. It is known for the transmission of music notes but other sources such as light, pressure, temperature, speed or electromagnetic field can be transcoded via MIDI. Considering this, the field of applications of MIDI becomes much wider… All you need is a powerful analogue to MIDI converter like ***eo•body*** and sensors of your choice. As a sensors to MIDI interface meaning to simplify the design of new gestural controllers or interactive sensor-based sound installations, ***eo•body*** converts analogue signals generated by sensors to MIDI messages which will be received by a sound generator and used to control parameters such as volume, panoramic, reverberation… The MIDI messages coding the gestures act directly on the sound, turning the whole system into a new kind of musical instrument. ***eo•body*** will transmit the sensors signal to the computer under digital form, through the MIDI standard. ***eo•body*** is fully compatible with any kind of devices featuring a MIDI interface (MIDI port) and makes a real bridge between the analogue world of sensors and digital audio control by gestures. Don't limit yourself: ***eo•body*** can convert to MIDI up to 16 sensors!

Internal process



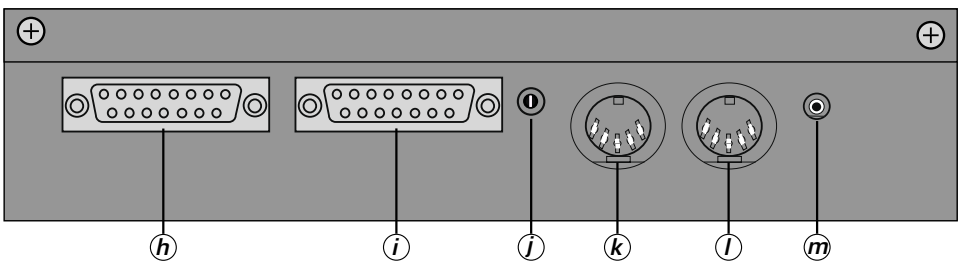
II - General Overview

Front view



a	**Powerplug status LED:**	lights up when plugged & when receiving valid SysEx data
b	**MIDI out LED:**	lights up when sending MIDI messages
c	**MIDI in LED:**	lights up when receiving MIDI messages
d	**[1-8]:**	serigraphy for inputs 1 to 8
e	**[9-16]:**	serigraphy for inputs 9 to 16
f	**Buttons A, B, C, D:**	free assignable MIDI buttons
g	**Potentiometers 1, 2, 3:**	free assignable MIDI potentiometers
h	**Inputs [1-8]:**	D-Sub connector 1 for the inputs 1 to 8
i	**Inputs [9-16]:**	D-Sub connector 2 for the inputs 9 to 16
j	**Maximal voltage:**	trimmer to set the maximal voltage range (see Appendix 1)
k	**MIDI in:**	MIDI in plug for receiving SysEx data from a computer
l	**MIDI out:**	MIDI out plug for sending MIDI data to your remote device
m	**9V DC power plug**	to be connected to the 9 V/500 mA power supply (European standard plug)

Rear view



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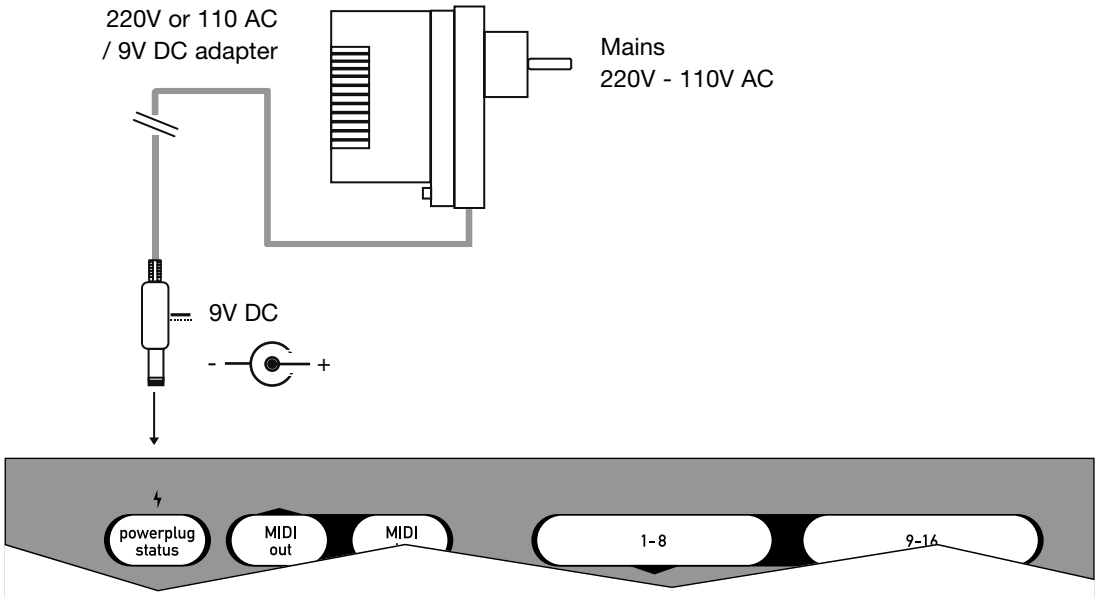
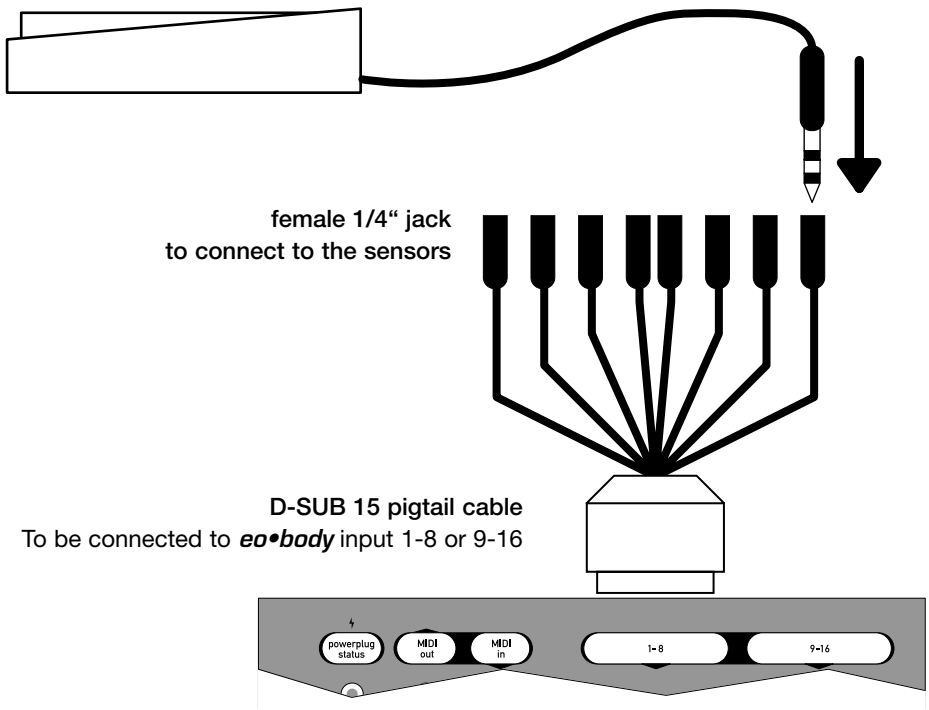
III - First steps

III.1. Power *eo•body*

Connect a 9 V DC / 500 mA power plug into the power plug connector of ***eo•body***. The red LED lights up when ***eo•body*** is well connected. An internal fuse is activated when not plugged right.



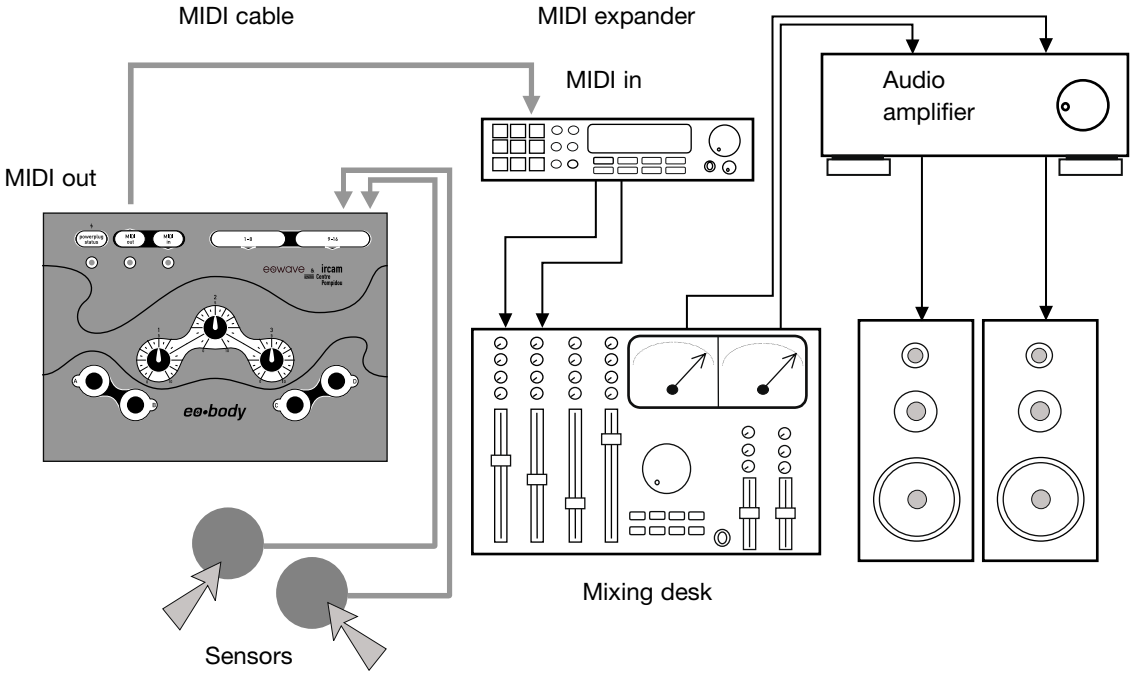
III.2. Connect a sensor to *eo•body*



A pigtail D-sub cable is delivered with ***eo•body***. The D-SUB connector may be plug either on the female D-SUB connector 1 for the inputs 1 to 8 or to the female D-Sub connector 2 for the inputs 9 to 16. Each of the 8 female 1/4” jacks from the pigtail cable may be connected to male 1/4” jack cable from a sensor.
Additional pigtails are available thru eowave.

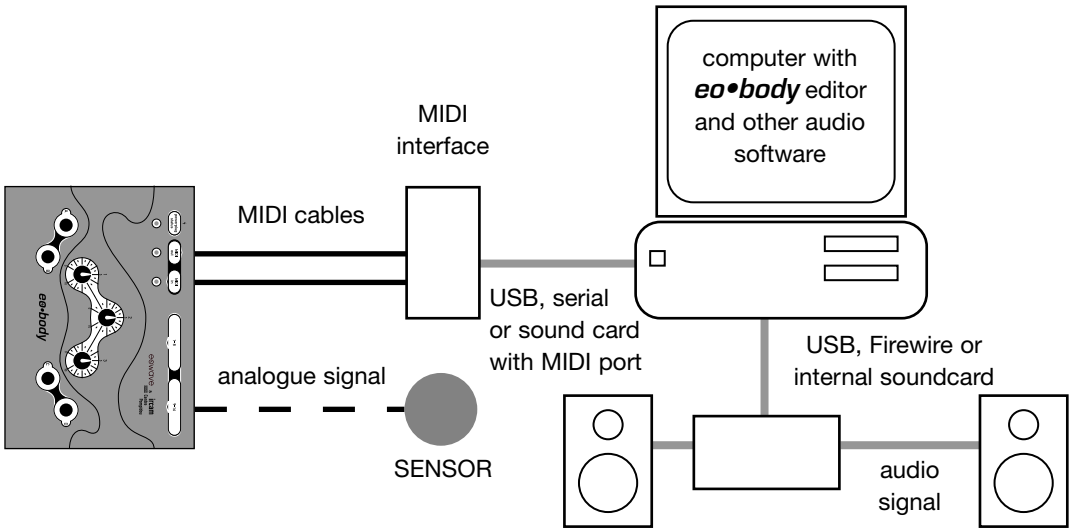
III.3. Basic Configuration

Basic configuration to control a MIDI expander with ***eo•body***
Plug the ***eo•body*** MIDI out to the MIDI expander MIDI in.



III.4. Connect *eo•body* to your computer

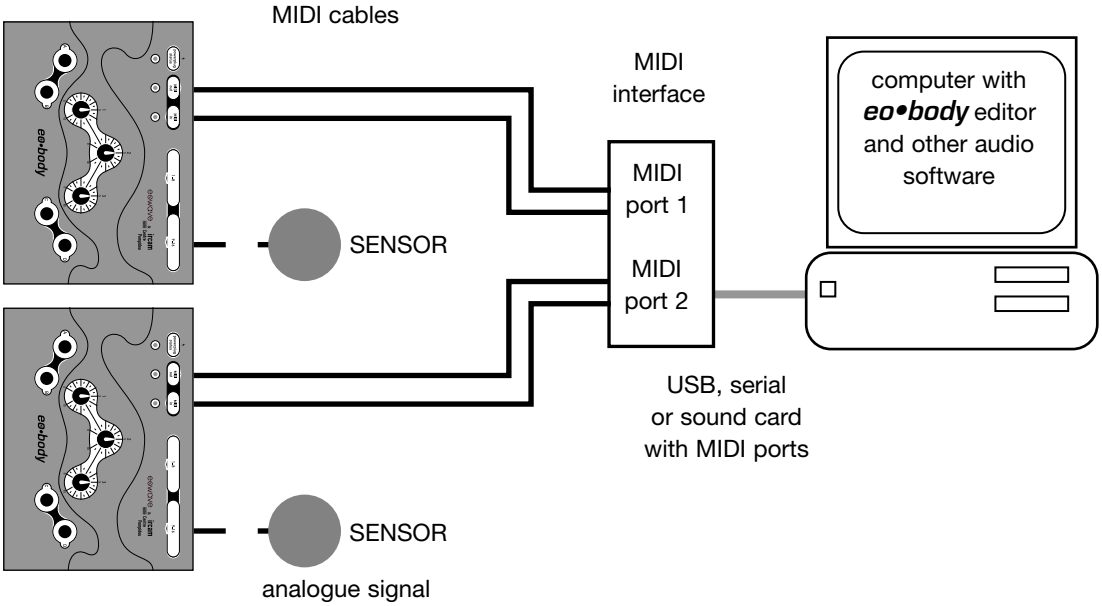
To connect ***eo•body*** to your computer, plug the ***eo•body*** MIDI out to the MIDI interface MIDI in from your computer. Plug the ***eo•body*** MIDI in to the MIDI interface MIDI out from your computer.



III.5. Use two *eo•body* or more

When using two ***eo•body,*** these units should be connected in parallel to the MIDI interface. It means that the MIDI interface requires 2 MIDI IN and 2 MIDI OUT ports. ***eo•body*** has no merging function. Therefore, two units cannot be connected in serial (but both ***eo•body*** on a unique MIDI IN and OUT using a MIDI merger). If you need more than 2 ***eo•body***, use as many different MIDI ports as the number of ***eo•body units.***

Our choice not to use merging capabilities was determined by our will to keep a 100% accurate data flow. Unfortunately, MIDI merging may be the source for losing informations provoking undesirable treatment delays. When using two MIDI ports, the delay generated will always be equal to the use of 16 active inputs, thus with 32 or more active inputs. The computer will merge data without losing information nor generating additional delays.



III.6. Reset *eo•body* to the factory settings

Should the ***eo•body*** need a factory reset, follow these instructions:

- On powering up the ***eo•body***, press the A & B buttons.

  > the red LED should flicker.

- Press now the D button.

  > The red LED should flicker faster.

- Power down the ***eo•body.***

  > The ***eo•body*** is reset to factory setting (i.e. controlers 1 to 7 on channel 1).

IV - Use *eo•body editor*

IV.1. Install *eo•body editor*

For Mac only

For now, ***eo•body editor*** is a Macintosh application only. A PC version will be developped in the nearest future.

Installation

For MacOS 9, you need OMS 2.3.8 installed in your computer.

Insert the ***eo•body CD*** delivered in the CD player from your computer. Move the ***eo•body folder*** on your hard disc. It contains one stand-alone application. Double-click on the icon to open it.

For Maxers

If you are a Max/MSP user, you may use the collective file to avoid two Max applications running on the same computer.

IV.2. *eo•body* editor menus

File Menu

Open, Save, Save as : opens, save and save as ***eo•body*** presets. Presets can be stored. They may be recall for a specific configuration.

MIDI Setup : Open the MIDI configuration setup.

Function Menu

Dump : Send a preset to ***eo•body***

Request : Request a preset from ***eo•body***

Inputs 1-8 : Open configuration window

Inputs 9-16 : Open configuration window

Switchs & knobs : Open switches & potentiometers configuration window

IV.3. First step with *eo•body* editor

When opening ***eo•body*** editor window, no parameters are set. To modify the configuration from ***eo•body***, you may first transfer its memory into the editor or recall a preset configuration already stored on your hard drive. To proceed to this transfer, you need a bi-directional MIDI connection with the MIDI out from your computer connected to the MIDI in from ***eo•body*** & the MIDI out from ***eo•body*** connected to the MIDI in from the computer. Ensure that you are using the same port on ***eo•body***.

The «request» button from the editor enables to send a message to ***eo•body*** to dump ***eo•body*** 's memory. ***eo•body*** 's memory contains will be dumped and its information will be displayed on the 1-8 Inputs Window, 9-16 Inputs Window or Knobs & Switches Window.
You may proceed to the modification from your configuration in two steps :
First, modify the parameters from your configuration directly on the editor. Secondly, dump your new configuration into ***eo•body***.

Once the modifications are stored, you may test your configuration with the Input Monitor Window from the ***eo•body*** editor : each bargraph shows the activity from each input.

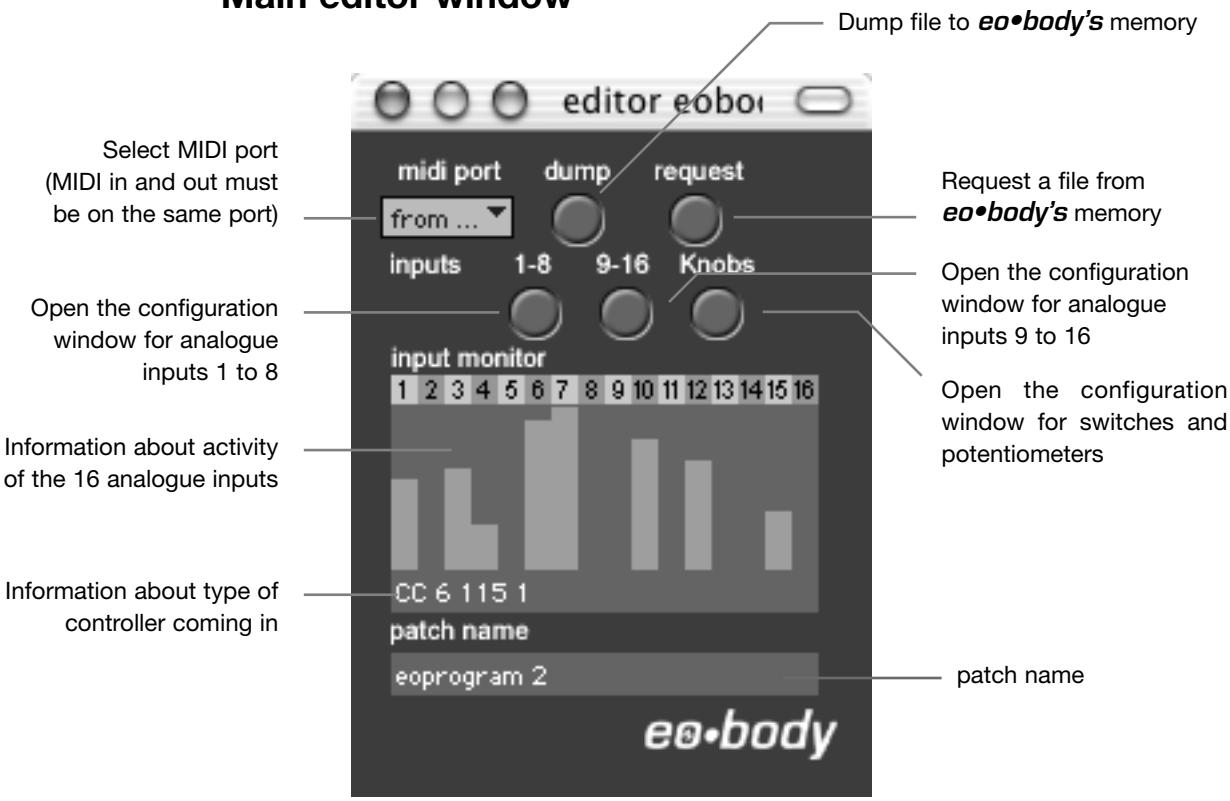
Note : 10 bits data are not represented by the Input Monitor Window.

Once tested, unplug ***eo•body*** 's connection from the computer.

eo•body has a non-volatile memory. You may also store your configurations onto your hard drive & recall them when desired.

IV.4. *eo•body* editor window

Main editor window


Dump file to eo•body's memory
editor eobo
midi port
dump
request
Select MIDI port (MIDI in and out must be on the same port)
from ...
Request a file from eo•body's memory
inputs
1-8
9-16
Knobs
Open the configuration window for analogue inputs 1 to 8
Open the configuration window for analogue inputs 9 to 16
input monitor
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Open the configuration window for switches and potentiometers
Information about activity of the 16 analogue inputs
Information about type of controller coming in
CC 6 115 1
patch name
eoprogram 2
patch name
eo•body

The **main editor window** offers one pop-up menu and 5 buttons: dump, request, 1-8, 9-16 and knobs.

midi port menu — enables to choose the transmission and reception port. Transmission and reception port has to be the same.

dump — dump a configuration/set up to ***eo•body***

request — request the current configuration/set up from ***eo•body***

1-8 — opens the configuration window for inputs [1-8]

9-16 — opens the configuration window for inputs [9-16]

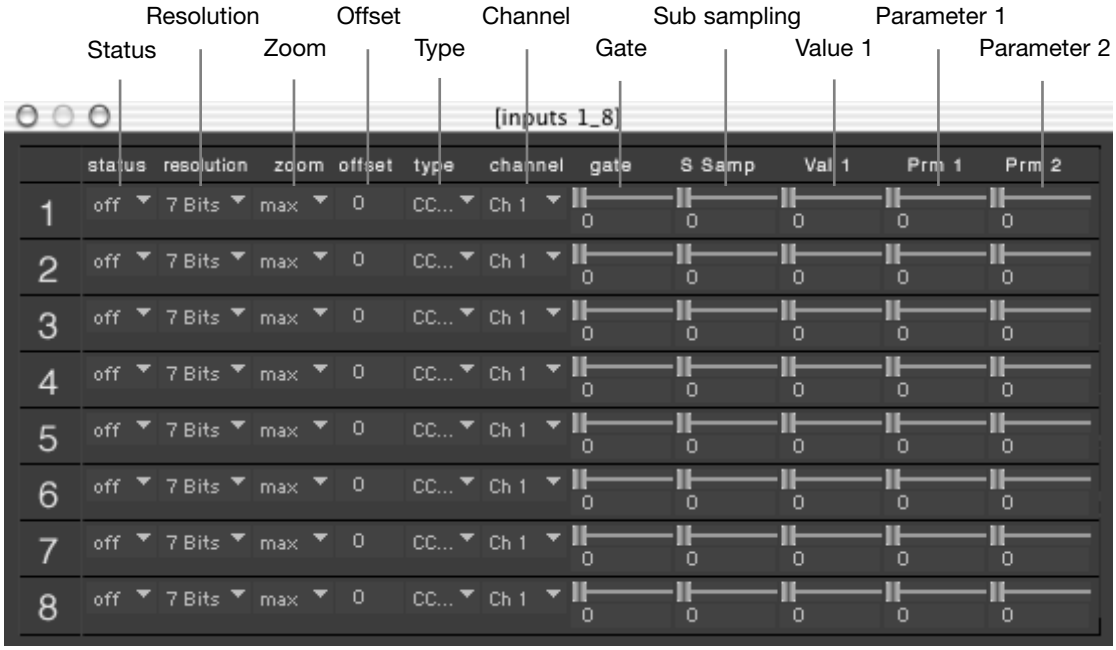
knobs — opens the configuration window «knobs & switches» for the setting of the 4 switches and the 3 potentiometers from the front panel of ***eo•body***.

Input monitor — gives information of what's coming in. 16 bars represent the data which are being sent from analogue inputs. More accurate information will also appear on the last line from the window.

Patch name — shows the name of the patch.

IV.5. *eo•body* input windows 1-8 & 9-16

The whole IV.5. part applies to both input windows 1-8 and 9-16, substitute inputs 9-16 to 1-8 where necessary.


Status
Resolution
Zoom
Offset
Type
Channel
Gate
Sub sampling
Value 1
Parameter 1
Parameter 2
[inputs 1_8]
status resolution zoom offset type channel gate S Samp Val 1 Prm 1 Prm 2
1 off 7 Bits max 0 CC... Ch 1 0 0 0 0 0
2 off 7 Bits max 0 CC... Ch 1 0 0 0 0 0
3 off 7 Bits max 0 CC... Ch 1 0 0 0 0 0
4 off 7 Bits max 0 CC... Ch 1 0 0 0 0 0
5 off 7 Bits max 0 CC... Ch 1 0 0 0 0 0
6 off 7 Bits max 0 CC... Ch 1 0 0 0 0 0
7 off 7 Bits max 0 CC... Ch 1 0 0 0 0 0
8 off 7 Bits max 0 CC... Ch 1 0 0 0 0 0

With this window, you may set the inputs 1 to 8 from ***eo•body***. Inputs 1 to 8 use a D-SUB connector.

Status

on/off

The status field indicates whether the signal on an analogue input should be converted into a MIDI message or not. This field may be set to ON or OFF. If the field is set to OFF, the input is said to be inactive and no MIDI message relating to that input will be generated, even if a signal does physically enter the device. If the field is switched back to ON, the input is active and its associated MIDI message will be sent each time the signal connected to that input varies in level.

Note: The smaller the number of active inputs is, the higher the acquisition frequency of the active inputs will be.

Resolution

Sets the resolution for sent data.
7 bits generates information from 0 to 127. This information format is used by most common hardware & software MIDI devices.
10 bits generates information from 0 to 1023. This is a more accurate format but can only be used to send pitch bend or CC data with MSB/LSB (Most Significant Bits/Least Significant Bits). MSB/LSB can only be used with softwares like Max/MSP, Jmax or PD.

Note about the high resolution:

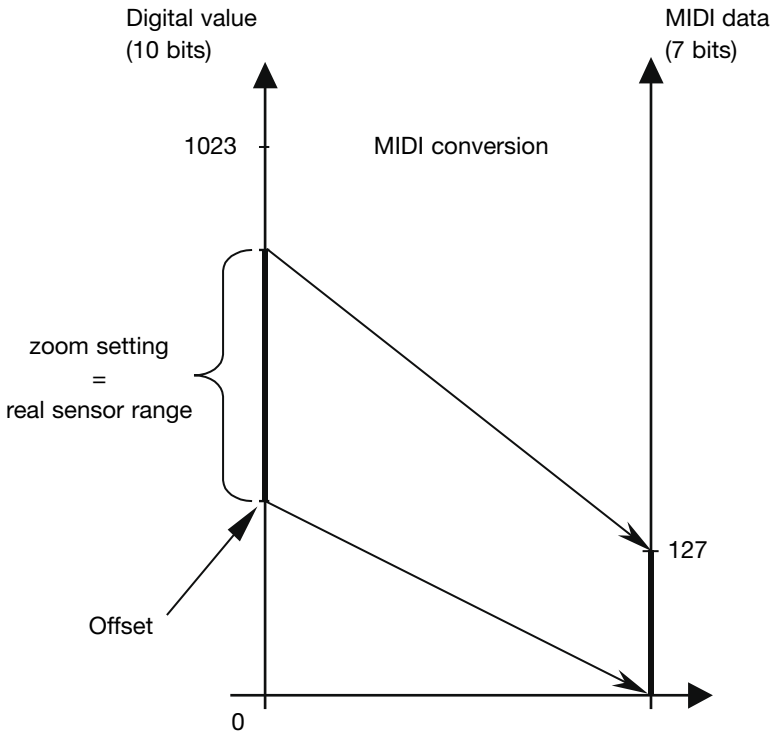
• For the pitch bend message, the 10 bits of the sampled value are mapped on the ten most significant bits of the MIDI message which actually counts 14 bits.

• For the control change message, the 3 Most Significant Bits (MSB) are sent via the Prm1 controller number whilst the «normal» controller number exports the 7 Least Significant Bits (LSB). To obtain the 10 bit value, the following calculation must be computed: 10 bit value = (MSB controller value X 128) + LSB controller value. A Max/PD Abstraction is avalaible on the CD. See «Combine Ctr».

Zoom & Offset

Zoom: max/mid/low/off
Offset: 0 to 895 (depending on zoom level)

Those two parameters specify how the real range of an analogue input can be mapped on a seven bit MIDI value. As a matter of fact, a sensor does not necessarily have a range equal to the reference voltage of the Analogue to Digital Converter. We have implemented a custom scaled zoom on the digital value to take advantage of the 10 bit resolution of the A/D converter. First, the voltage reference has to be set to the largest range among the sensors connected to the unit. Then, the user can select the sensor's range within the 10 bits dynamic by specifying a window size and an offset. The selected range can then be converted into 7 bits MIDI data without greatly increasing the quantification step, as shown in the following illustration.



Type

This is one of the most important configuration parameters, since it determines which type of MIDI message the device is going to send in response to variations in a particular analogue input. ***eo•body*** is capable of generating 6 different messages:

- **CC:** Control number change (Control change)
- **Note:** Note on Trigger
- **PC:** Program change
- **PB:** Pitch bend (Variation in pitch)
- **ATp:** Polyphonic aftertouch (Polyphonic pressure)
- **ATm:** Monophonic aftertouch (Channel pressure)

Control Change

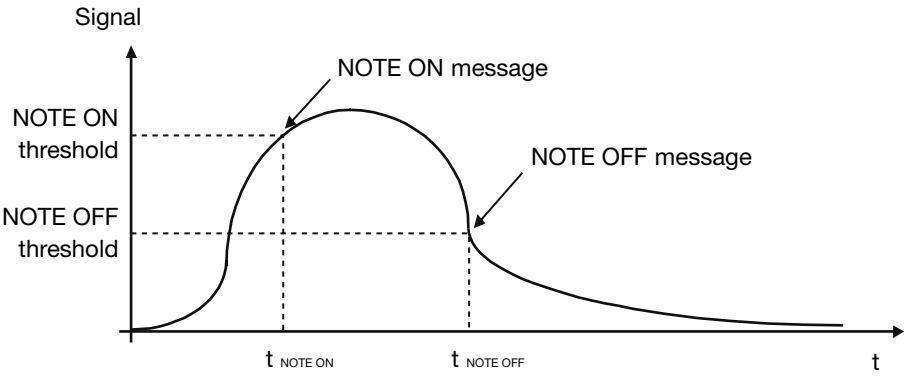
CC

This is the type of message which will likely be most often used for controlling sound parameters. The value of the analogue signal acts directly upon the value of a MIDI controller, using a MIDI controller Value Change message (control change). The number of the controller can be set by the user. If 10 bits resolution is selected, this message will actually send two Control Change messages. The controller specified in the val field will send the 7 least significant bits whilst the controller specified in the prm1 field will send the 3 most significant bits, on the same MIDI channel.

Note on message

N-ON trigger

The analogue signal must correspond to an envelope changing with time and which has a maximum value. You will have to specify 3 parameters, note sent, higher treshhold, lower treshhold. ***eo•body*** analyses this envelope: once the envelope has reached the higher treshhold, a MIDI note on message (NOTE ON) is generated. The velocity associated with the note is fixed to 127. The note number contained within the message is adjustable by the user. As long as the envelope stays above a threshold, named NOTE OFF threshold, the note is maintained (no new MIDI message is sent). When the level falls beneath the NOTE OFF threshold, a MIDI NOTE OFF message is sent to turn the note off. To sustain the note for a long period of time, you just need to give a small value to the NOTE OFF threshold. Conversely, to make the note stop shortly after the peak has been detected, you need to set the NOTE OFF value quite large. This type of message is useful in using sensors to generate MIDI notes.



Program Change message

PC

The analogue signal must correspond to an envelope changing with time and which has a maximum value. You will have to specify 3 parameters, Program Change sent, higher treshhold, lower treshold. ***eo•body*** analyses this envelope: once the envelope has reached the higher threshold, a MIDI Program Change message is generated. The Program Change contained within the message is adjustable by the user. As long as the envelope stays above a threshold, named lower threshold, the Program Change is maintained (no new MIDI message is sent). When the level falls beneath the lower threshold, the ***eo•body*** is ready to receive a new Program Change message.

Pitch bend

PB

This message allows an analogue signal to generate a MIDI message of the pitch change type (pitch bend). Pitch is usually coded over 14 bits. If the 7 bits resolution is chosen, they will be mapped on the 7 most significant bits of pitch information controlled by the analogue signal. However, since ***eo•body*** does 10 bits conversions internally, the whole 10 bits can be mapped to take better advantage of the pitch bend message. This message is used to simulate the pitch changing wheels available on most MIDI keyboards.

Polyphonic Aftertouch

ATp

This message allows an analogue signal to generate a polyphonic pressure type MIDI message (polyphonic aftertouch). The number of the note to which the pressure information is applied can be changed by the user.

Monophonic Aftertouch

ATm

This message allows an analogue signal to generate a channel pressure type MIDI message (channel aftertouch). This pressure message affects a whole MIDI channel, regardless of what note is played. The channel number to which the pressure information is applied is selected by the user.

Channel

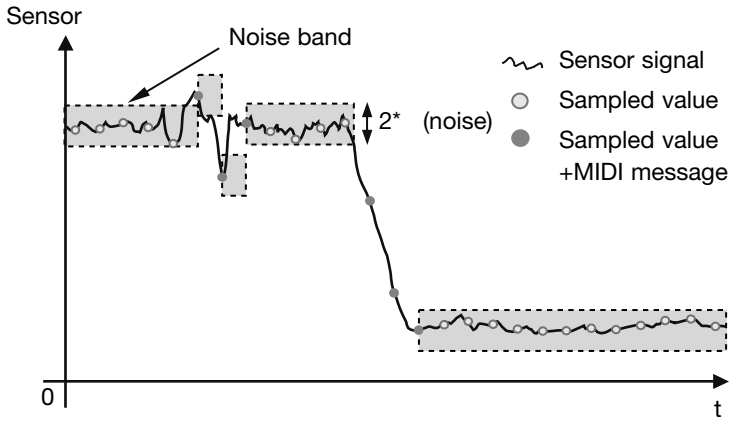
MDI Channel: [1-16]

This field enables the user to select a MIDI channel to which the MIDI message will apply (1 to 16).

Gate

Noise Gate: [0-127]

The noise gate threshold specifies the variation of the analogue signal that would be detected as a change. If the analogue signal moves inside the range of the noise gate, no MIDI message will be sent. This field enables the user to set the width of the range. A large range will be very effective against strong noise but will make the MIDI value less sensitive to a relevant change of the analogue signal. For a reference voltage of +5V a threshold of 8 corresponds to a noise level of ± 40 mV (ie: the analogue has to change at least of 40 mV above or under its current position to be detected as changing). A threshold of 127 corresponds to a ribbon of ± 620 mV of noise.



S Samp

subsamp

This field enables the user to adjust the subsampling filter. SUBSAMP is a subsampling filter (also called downsampling filter). It will make ***eo•body*** analyse the analogue input not every scan cycle.
Thus, fast changes on the signal will not be detected resulting a low-pass filter. The number of «wasted cycles» is configured in the Nb Cycles field.

Val 1

val: 0 - 127

This field enables the user to set the fixed parameter of a MIDI message associated with an analogue input. This parameter value may correspond to a MIDI note number, a MIDI controller number or a MIDI program number, depending on the type of MIDI message which is chosen.

Prm1

multipurpose
parameter #1
0 - 127

This field enables the user to configure the note on activation level for trigger messages or for the MSB controller number.

Prm2

multipurpose
parameter #2
0 - 127

Same as Prm 1, depending on what type of MIDI information are sent.

Configuration map for analogue inputs

Type of message	Res.	Val1	Prm1	Prm2
CC - Control Change	7 bits	CC value		
CC - Control Change	10 bits	CC MSB	CC LSB	
Note - Note on trigger	7 bits	note number	higher threshold	lower threshold
PC - Program Change	7 bits	PG value	higher threshold	lower threshold
PB - Pitch Bend	7 bits			
PB - Pitch Bend	10 bits			
ATp - polyphonic aftertouch	7 bits	note number		
ATm - monophonic aftertouch	7 bits			

IV.6. Knobs & Switches Window

Enables to set the 4 switches and the 3 potentiometers from the front panel of ***eo•body***. Note that switches and potentiometers do not transmit the same kind of information. Switches transmit Control Change messages, Note On, Note Off, Pogram Changes. Potentiometers transmit Control Change messages, Pitch Bend, Polyphonic Aftertouch, Monophonic Aftertouch.

Type

This is one of the most important configuration parameters, since it determines which type of MIDI message the device is going to send in response to variations in a particular analogue input. ***eo•body*** is capable of generating the messages as follow.

Applicable to switches:

- **CC:** Control number change (Control change)
- **Note:** Note on Trigger
- **PC:** Program change

Applicable to potentiometers:

- **CC:** Control number change (Control change)
- **PB:** Pitch bend (Variation in pitch)
- **ATp:** Polyphonic aftertouch (Polyphonic pressure)
- **ATm:** Monophonic aftertouch (Channel pressure)

For the description of these parameters, see the IV.2 ***eo•body*** input windows 1-8 & 9-16 section.

Channel

Ch: [1-16]

This field enables the user to select a MIDI channel to which the MIDI message will apply (1 to 16).

Value

Val: 0-127

This field enables the user to set the fixed parameter of a MIDI message associated with an analogue input. This parameter value may correspond to a MIDI note number, a MIDI controller number or a MIDI program number, depending on the type of MIDI message which is chosen.

IV.7. Configuration example

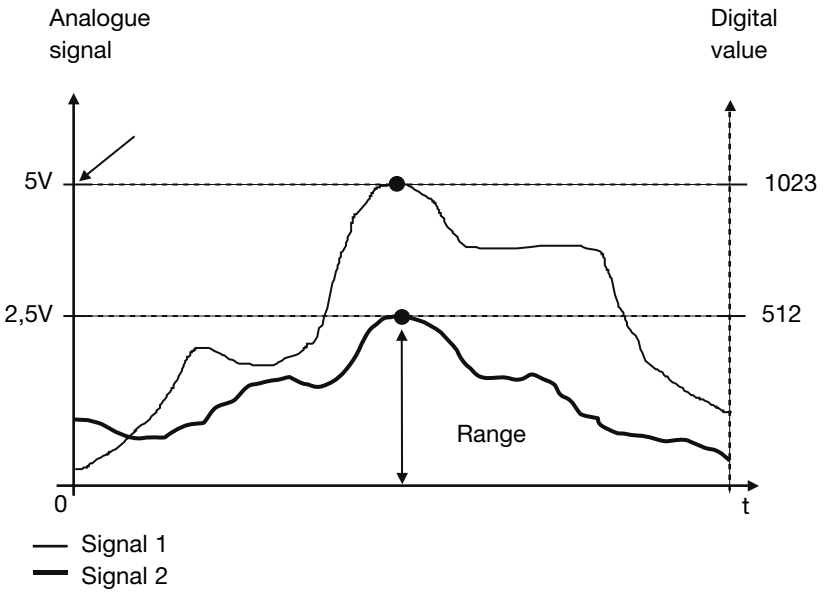
To set Controller #1 on channel 1 from ***eo•body*** using input 1, with a pedal for example.

1. Connect ***eo•body*** to your computer
2. Open ***eo•body*** Editor, press the «request» button from the editor, open 1-8 Inputs Window & configure input 1 parameters
3. Set status on
4. Select 7 bit
5. Set zoom off - offset will be automatically disactivated
6. Select type CC
7. Select channel 1
8. Open gate on 8
9. Set subsampling on 0
10. Set val1 to 1
11. Prm1 & Prm2 are not used in this configuration
12. DUMP
13. Plug the 1/4" jack from the foot pedal into the female 1/4" jack from the channel 1 of the pigtail cable.
14. Start playing with the foot pedal. The green bargraph from the main editor window should follow your moves.
15. The sensor (foot pedal) is now ready to be used within other applications. Once set so, you don't need the ***eo•body*** editor anymore.
    You may unplug ***eo•body*** from your computer.

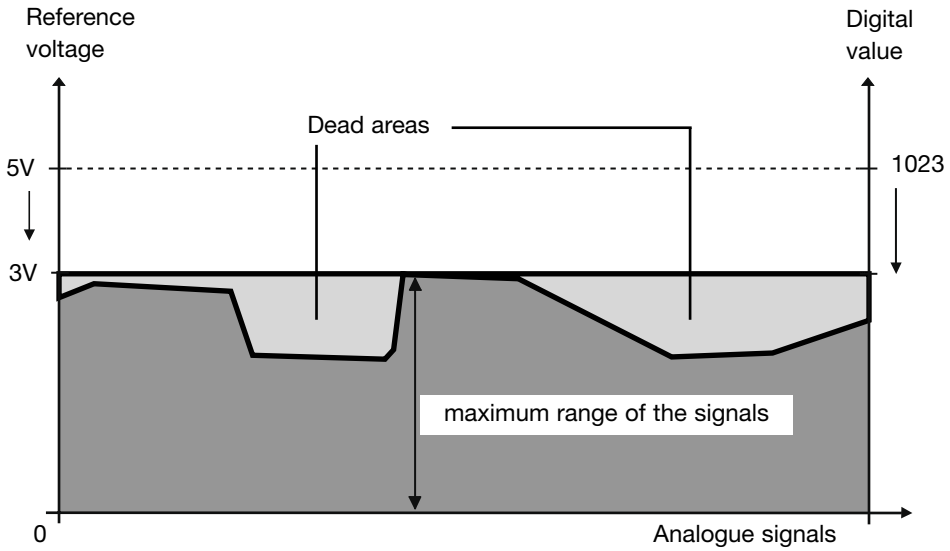
Appendices

1 - Maximal Voltage Range for global scaling

The trimmer position enables to set the maximal analogue voltage before conversion to digital. It means that analogue signal from 0 to 5 Volts will be converted into digital values from 0 to 1024. Some sensors may have a range from 0 to 4 Volts. To get the maximal digital range, the trimmer should be adjusted to 4 Volts. Note that voltage references value below 2.5V may increase sensitivity to noise.



When the Maximal Voltage Range is set under the maximal voltage from the sensor, the signal may clip and some information may be lost. Always ensure that the reference voltage is set to the maximum range of the connected sensors.



2 - Example of a Sysex configuration of an *eo•body* preset

The whole sysex file has to be sent at one time

To modify parameters, values from row 3 for the switches, from row 4 for the potentiometers, from row 6 to 23 for imputs 1 to 16 need to be adjusted.

0,	'eoprogram ';	program name (for internal use of the editor only)
1,	240 0 32 57 64 127;	header tag (not to be changed)
2,	0 8 0 0;	empty informations for further use
3,	1 0 1 0 1 0 2 0 1 0 3 0 1 0 4 0;	switch configuration
4,	1 0 5 0 1 0 6 0 1 0 7 0;	potentiometer configuration
5,	0 0;	empty informations for further use (not to be changed)
6,	0 0 8 0 0 8 1 0 0 0 0 0 3 0 0 0 0 0;	input 1 configuration
7,	0 0 8 0 0 8 2 0 0 0 0 0 3 0 0 0 0 0;	input 2 configuration
8,	0 0 8 0 0 8 3 0 0 0 0 0 3 0 0 0 0 0;	input 3 configuration
9,	0 0 8 0 0 8 4 0 0 0 0 0 3 0 0 0 0 0;	input 4 configuration
10,	0 0 8 0 0 8 5 0 0 0 0 0 3 0 0 0 0 0;	input 5 configuration
11,	0 0 8 0 0 8 6 0 0 0 0 0 3 0 0 0 0 0;	input 6 configuration
12,	0 0 8 0 0 8 7 0 0 0 0 0 3 0 0 0 0 0;	input 7 configuration
13,	0 0 8 0 0 8 8 0 0 0 0 0 3 0 0 0 0 0;	input 8 configuration
14,	0 0 8 0 0 8 9 0 0 0 0 0 3 0 0 0 0 0;	input 9 configuration
15,	0 0 8 0 0 8 10 0 0 0 0 0 3 0 0 0 0 0;	input 10 configuration
16,	0 0 8 0 0 8 11 0 0 0 0 0 3 0 0 0 0 0;	input 11 configuration
17,	0 0 8 0 0 8 12 0 0 0 0 0 3 0 0 0 0 0;	input 12 configuration
18,	0 0 8 0 0 8 13 0 0 0 0 0 3 0 0 0 0 0;	input 13 configuration
19,	0 0 8 0 0 8 14 0 0 0 0 0 3 0 0 0 0 0;	input 14 configuration
20,	0 0 8 0 0 8 15 0 0 0 0 0 3 0 0 0 0 0;	input 15 configuration
21,	0 0 8 0 0 8 0 1 0 0 0 0 3 0 0 0 0 0;	input 16 configuration
22,	247;	Footer tag (not to be changed)

Switches and potentiometers use the same parameters

Switch configuration 4 x 2 bytes for switches A, B, C, D
Potentiometer configuration 3 x 2 bytes for potentiometers 1, 2, 3
channel C (0-15, type of information X (0-5), value 0 0 (0-127, in 8 bits on 2 bytes)
C X 0 0

Example:

Controller 1 on Channel 1: 0 0 1 0
Controller 64 on Channel 16: 15 0 0 4

Type of information

0 CC
1 Note On Trigger
2 Program Change
3 Picht Bend
4 Polyphonic After Touch
5 Monophonic After Touch

An entire sequence for pots will be

Example CC 1 to 3 on Channel 1
4, 0 0 1 0 0 0 2 0 0 0 3 0;

Configuration of inputs 1 to 16 is the same for each input

6, 0 0 8 0 0 8 1 0 0 0 0 0 3 0 0 0 0 0 example of input 1
status ON, 7 resolution, zoom off, offset O, type CC, Channel 1, Gate 8, Subsamp 0, Val1 1, Prm 1 0, Prm2 0

All parameters in 8 bit format on 2 bytes except for the offset in 14 bits on two 8 bits values (MSB/LSB)

Note: some parameters are coded on the same bit

1	0 0	subsampling
2	0 0	gate + resolution (gate + 128 for 10 bits, gate + 0 for 7 bits)
3	0	MIDI Channel
4	0	Type of controller +status ON/OFF (Type + 8 for ON, Type + 0 for OFF)
5	0 0	Value 1 (0-127)
6	0 0	Prm 1 (0-127)
7	0 0	Prm 2 (0-127)
8	0 0	Zooming (0-3) - (0 is max, 3 is off)
9	0 0 0 0	offset in 14 bits only the first 10 bits are used

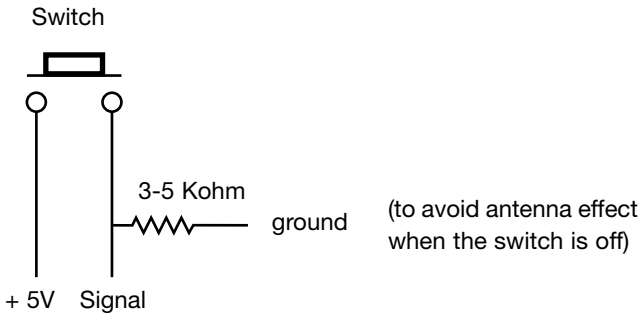
A code which is directly sent to *eo•body* will be like:

240 0 32 57 64 127 0 8 0 0 15 0 0 4 0 0 2 0 1 0 3 0 1 0 4 0 0 0 1 0 0 0
2 0 0 0 3 0 0 0 0 0 8 0 0 8 1 0 0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 2 0 0 0
0 0 3 0 0 0 0 0 0 0 8 0 0 8 3 0 0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 4 0 0 0
0 0 3 0 0 0 0 0 0 0 8 0 0 8 5 0 0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 6 0 0 0
0 0 3 0 0 0 0 0 0 0 8 0 0 8 7 0 0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 8 0 0 0
0 0 3 0 0 0 0 0 0 0 8 0 0 8 9 0 0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 10 0 0
0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 11 0 0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 12 0
0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 13 0 0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 14
0 0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8 15 0 0 0 0 0 3 0 0 0 0 0 0 0 8 0 0 8
0 1 0 0 0 0 3 0 0 0 0 0 247

3 - Making my own sensors

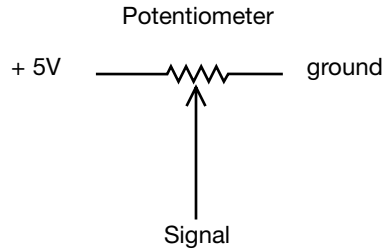
eo•body supports many kind of sensors. Most common sensors are switches and potentiometers, but there are many other kinds of sensors.

Making my own sensor switch



Sensors need a minimum of two cables: ground and signal. When 5 V is connected to the signal - when using switches for example - it may create an antenna effect generating undesirabled distorsion. This is the reason why the signal must be connected to the ground.

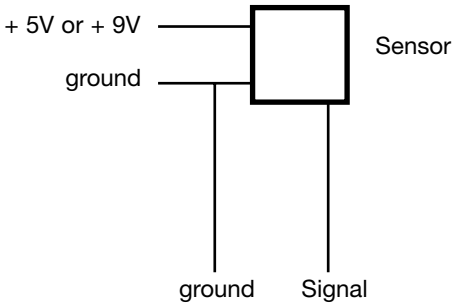
Making my own sensor potentiometer



To use a standard potentiometer with ***eo•body***, connect both outputs of the potentiometer resistor to the ground and 5 V. Connect the variable output of the potentiometer to the signal input.

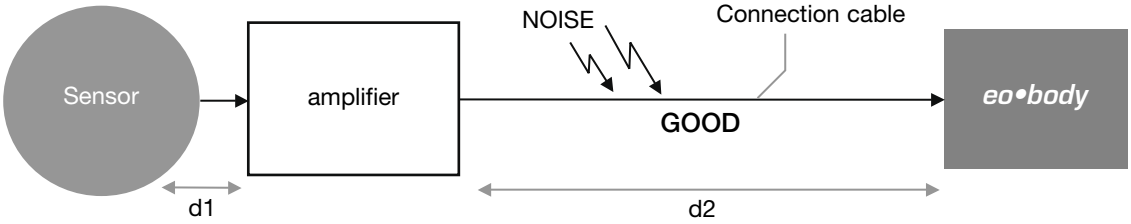
Making my own sensor with other kinds of sensors

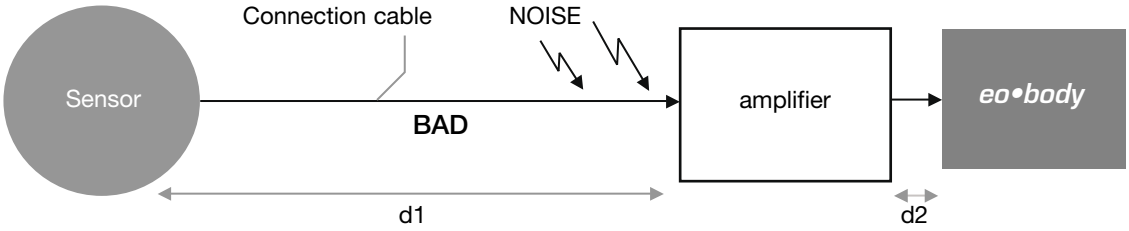
Coming from ***eo•body*** or external power supply (any other voltage has to come from an external power supply)



Some sensors like distance sensors need an extra power supply. ***eo•body*** delivers +5V and +9V to power these sensors up to 250 mA. When the total consumption from all the sensors plugged to ***eo•body*** is higher than 250 mA, an additional external power supply is necessary.

Some sensors have a weak signal out and need amplifying. To avoid undesirable noises, the amplifier should be placed as close as possible from the sensor.



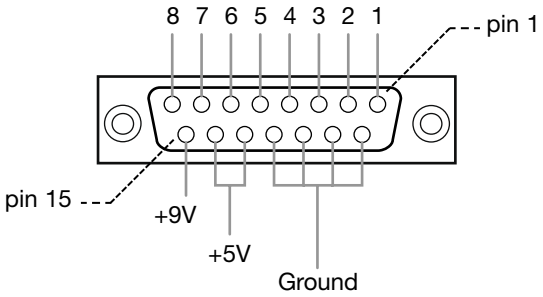


d1<<d2

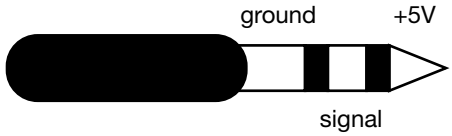
Analogue Input Connections

D-SUB 15 Wiring

1.	signal 1	9.	gnd
2.	signal 2	10.	gnd
3.	signal 3	11.	gnd
4.	signal 4	12.	gnd
5.	signal 5	13.	+5V
6.	signal 6	14.	+5V
7.	signal 7	15.	+9V
8.	signal 8		



Jack 1/4“ - 6,35 mm



Jack plug 1/4“ - 6,35 mm

Tip: +5V
Ring: signal
Sleeve: ground

4 - List of MIDI Controllers

N°	Function	Value		N°	Function	Value	
0	Bank Select	0-127	MSB	65	Portamento on/off	≤63=off ≥64=on	
1	Modulation wheel	0-127	MSB	66	Sustenuto on/off	≤63=off ≥64=on	
2	Breath control	0-127	MSB	67	Soft pedal on/off	≤63=off ≥64=on	
3	Undefined	0-127	MSB	68	Legato footswitch	≤63=off ≥64=on	
4	Foot controller	0-127	MSB	69	Hold 2	≤63=off ≥64=on	
5	Portamento time	0-127	MSB	70	Sound Controller 1	0-127	LSB
6	Data Entry	0-127	MSB		(Sound Variation)		
7	Channel Volume	0-127	MSB	71	Sound Controller 2	0-127	LSB
	(formerly Main Volume)				(Timbre)		
8	Balance	0-127	MSB	72	Sound Controller 3	0-127	LSB
9	Undefined	0-127	MSB		(Release Time)		
10	Pan	0-127	MSB	73	Sound Controller 4	0-127	LSB
11	Expression Controller	0-127	MSB		(Attack Time)		
12	Effect control	0-127	MSB	74	Sound Controller 5	0-127	LSB
13	Effect control	0-127	MSB		(Brightness)		
14	Undefined	0-127	MSB	75	Sound Controller 6	0-127	LSB
15	Undefined	0-127	MSB	76	Sound Controller 7	0-127	LSB
16-19	General Purpose	0-127	MSB	77	Sound Controller 8	0-127	LSB
	Controler			78	Sound Controller 9	0-127	LSB
20-31	Undefined	0-127	MSB	79	Sound Controller 10	0-127	LSB
32	Bank Select	0-127	LSB	80-83	General Purpose	0-127	LSB
33	Modulation	0-127	LSB		Controller (5-8)		
34	Breath control	0-127	LSB	84	Portamento Control	0-127	Source
35	Undefined	0-127	LSB				Note
36	Foot controller	0-127	LSB	85-90	Undefined	0-127	LSB
37	Portamento time	0-127	LSB	91	Effect 1 Depth	0-127	LSB
38	Data entry	0-127	LSB	92	Effect 2 Depth	0-127	LSB
39	Channel Volume	0-127	LSB	93	Effect 3 Depth	0-127	LSB
	(formerly Main Volume)			94	Effect 4 Depth	0-127	LSB
40	Balance	0-127	LSB	95	Effect 5 Depth	0-127	LSB
41	Undefined	0-127	LSB	96	Data entry +1	N/A	
42	Pan	0-127	LSB	97	Data entry -1	N/A	
43	Expression Controller	0-127	LSB	98	Non registered	0-127	LSB
44	Effect control 1	0-127	LSB		Parameter Number LSB		
45	Effect control 2	0-127	LSB	99	Non registered	0-127	LSB
46	Undefined	0-127	LSB		Parameter Number MSB		
47	Undefined	0-127	LSB	100	Registered	0-127	LSB
48-51	General Purpose	0-127	LSB		Parameter Number LSB		
	Controller (1-4)			101	Registered	0-127	LSB
52-63	Undefined	0-127	LSB		Parameter Number MSB		
64	Damper pedal	≤63=off ≥64=on		102-119	Undefined		
	on/off (Sustain)			120-127	Mode messages		

5 - MIDI Implementation Chart

Function...		Transmitted	Recognized	Remarks
Basic Channel	Default changed	* 1-16 * 1-16	X X	memorised
Mode	default Messages Altered	Mode 3 X X	X X X	
Note Number	True Voice	* 0-127 * 0-127	X X	memorised
Velocity	NOTE ON NOTE OFF	1-127 64	X X	
After Touch	Key Channel	o o	X X	
Pitch Bender		o	X	10 bit resolution
Control Change		* 0-127	X	memorised
Program Change		* 0-127	X	Program number 1-128
System Exclusive		o	o	
System Common	Song Pos Song Sel Tune	X X X	X X X	
System Real time	Clock Commands	X X	X X	
AUX Messages	Local ON/OFF All Notes OFF Active Sense Reset	X X X X	X X X X	

Mode 1: OMNI ON, POLY
Mode 2: OMNI ON, MONO
Mode 3: OMNI OFF, POLY
Mode 4: OMNI OFF, MONO

o: Yes
X: No

Technical specifications

Dimensions:	Width	182 mm	
	Depth	128 mm	
	High	38 mm	(knobs high excluded)
Weight:	**580 g**		
Impedancy:	1 MΩ		
Latency:	around 200 µs by active in, A/D conversion added excluding MIDI message		
MIDI Message adds:	980 µs per control change without running status		
Running status adds:	640 µs per control change (i.e. 1280 ms for a 10 bits send)		

Optimise Running status up to 33%:
Keep it on the same MIDI channel (some latency is added by changing MIDI channel). If you need different MIDI channels, make sure to group your sensors as follow:

- Sensors 1 to 5, MIDI channel 3
- Sensors 6 to 14, MIDI channel 8

Power consumption: 25 mA under 9V DC, internal diameter of the plug: 2,5 mm

Thermic fuse: Polyswitch operating at 250 mA

CE

CE norm & FCC INFORMATION

1. Important notice: do not modify this unit!
This product, when installed as indicated in the instructions contained in this manual, is compatible with the CE norm & FCC requirements.

2. Important!
When connecting this product to accessories and/or another product, use only high quality shielded cables. Cables supplied with this product must be used. Follow all installation instructions. Failure to follow instructions could void your FCC authorisation to use this product in the USA.

Note: this product has been tested and found to comply with the requirements listed in FCC Regulations, Part 15 for Class B digital devices & in The European Standard EN 50081-1 on Electromagnetic Compatibility - Generic emission standard on residential, commercial and light industry. Compliance with these requirements provides a reasonnable level of assurance that the use of this product in a residential environment will not result in harmful interference with other electronic devices.

eo•body Development Team

Emmanuel Flety, Ircam (hardware design, micro controller programming, PCB)
Marc Sirguy, MESI/eowave CEO (concept, specs, software, production, distribution)
Emmanuelle Gallin, MESI/eowave manager (executive manager)
Denis Germain, MESI/eowave (graphic design)

Thanks

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